Ssembatya has come to you for advice on the nature of materials to use.

Task

As a student with chemistry knowledge

a) Explain

(i) Categories of materials

Materials are categorized into two, natural materials and synthetic materials.

Natural materials; God made materials/materials that exist freely in nature e.g. wood, sand etc.

Synthetic materials; man made materials e.g. iron bars, glass, concrete, bricks, etc.

(ii) The suitability of materials

Suitability of using iron bars

-Durable/long lasting

-Good conductor of heat and electricity

-Malleable/can be reformed into other shapes i.e. sheets

-Hard

-High tensile strength

-Water proof, etc.

Iron bars can be used to make window and door frames since they are strong.

(iii) Advice of Ssembatya on the choice of the materials.

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Iron bars are non-bio degradable/don't rot, when disposed off into the soil prevent air and water entry into the soil leading to soil infertility. This can be mitigated by recycling iron bars, among others.

Item 2

Harriet who lives near a market sometimes goes to buy commodities in the market, the commodities are wrapped in packaging materials. However some of packaging materials she uses to carry commodities are not strong enough and not good to carry liquid commodities.

She has come to you for help such that she can buy packaging materials with improved properties

Task: As a chemistry learner advise her on right packaging materials to buy

a) Explain the category of materials.

Synthetic materials; man made materials e.g. plastics

b) State the properties of the material mentioned above and give one use a material.

Suitability of using plastics
-Durable/long lasting
-poor conductor of heat and electricity
-flexible
-resistant to chemicals
-High tensile strength
-Water proof, etc.

Plastics are used to make insulators of electrical appliances since it is a poor conductor of electricity.

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c) State one danger of the material on the environment and its mitigation.

Plastics are non-bio degradable/don't rot, when dumped into the soil prevent air and water entry into the soil leading to soil infertility. This can be mitigated by recycling iron bars, among others.

Burning of plastics leads to release of smoke which causes breathing difficulties, eye irritation etc. this can be mitigated by proper disposal of plastics.

Item 3

A new knitting farm in Entebbe Uganda makes sweaters from cotton. However clients are complaining that these are easily decomposed by moths and carpet beetles.

The operations manager has heard of nylon as an alternative .she is uncertain of its nature, composition an effect on the environment.

She has contacted you as someone with knowledge of chemistry to guide her in making a better choice.

Tasks;

As someone with knowledge of chemistry,

Explain the
i) category of the materials material.

Materials are categorized into two, natural materials and synthetic materials.

Natural materials; God made materials/materials that exist freely in nature e.g. cotton

Synthetic materials; man made materials e.g. nylon

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leading to suffocation of aquatic animals. This can be mitigated by stopping pouring water after washing into the water bodies

Practicing agriculture involves application of artificial fertilizers in the soil, these are highly soluble and carried into water bodies when it rains hence leading to water contamination resulting into change of water colour, among others. This can be mitigated by using natural fertilizers, applying less artificial fertilizers, etc.

Water is used for drinking, water helps the body to get rid of toxic wastes from the body.

Item 13

Peter the cattle keeper grazes his cattle on community land. During the dry season he practices bush burning and also takes his cattle to drink water from the community water source. Peter's practices have raised concern in the community.

The area chairperson has organized a meeting to create awareness for peter and the community.

Task;

As a learner of chemistry make a write-up of the message the chairperson will present to the community.

Renewable natural resources; these are resources which can easily be replaced/replenished once used up for example air, water.

Bush burning produces a lot of smoke in the atmosphere which contains carbon dioxide which is a greenhouse gas that causes global warming. This can be mitigated by using alternative methods that are not harmful to the environment like slashing the bush.

Air contain oxygen which used in respiration; food is broken down in presence of oxygen to produce energy.

Item 14

Osukuru village in Tororo district is at the foot of Tororo rock. People of this village for a long time have practiced charcoal burning ,animal

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husbandry, crop husbandry and stone quarrying, recently the animals started dying and wells are drying up yet the little water available is not fresh. The locals are now wondering why these are happening.

A sensitization workshop is to be organized to explain the existing situation in the village. The theme of the workshop is **MY ENVIRONMENT MY RESPONSIBILITY**.

Task

As a chemistry student, write a message you will deliver upon invitation.

Item 15

The setup of crude oil mine in Hoima district resulted in the displacing of residents to other places but the displaced people are still not contented. This has made the government to intervene.

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During mining, smelting and industrial processes, they can get in contact with water and soil, polluting them and causing harm to organisms, mitigated by handling them carefully during the above named processes.

SOAPS AND DETERGENTS

Item 18

An argument took place between a brother and his sister concerning how to wash clothes clean. The brother said White star or Magic gives best results but the sister insists on Blue star or Omo.

They failed to reach an agreement.

Task;

a) Classify the products mentioned into two categories and give a general name for each category.

Soapy detergents; white star

Soapless detergents; Omo, Magic

b) Briefly how one of the products work.

Soap molecules consists of hydrophilic end /water attractive and hydrophobic end/water repellent; when soap is added to water acts by lowering surface tension of water; the hydrophilic end reacts with water and hydrophobic end reacts with dirt in the fabric; dirt is removed from fabric by rubbing/mechanical action which breaks down dirt into small droplets and this is followed by rinsing the fabric to obtain a clean fabric.

c) State the dangers of using the product you referred to in b) excessively.

Excessive use of soap causes eye irritation; this can be mitigated by washing eyes with a lot of clean water.

d) Give the similarity and difference between the cleansing agents used by the brother.
Similarities

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Both soapy and soapless detergents remove dirt from clothes

Both are effective in soft water/rain water

Differences

Soapy detergents form scum with hard water well as soapless detergents don't form scum with hard water

Soapy detergents hardly form lather with hard water well as soapless detergents readily form lather with hard water.

Item 19

In one of the towns in Uganda, residents are facing an unexpected challenge of water wasting detergents. The locals are frustrated and do not know what to do. They have been advised to try other alternatives on the market to overcome the challenge but they need more advice on this.

As a concerned chemistry student in town,

Task;

Help the residents,

(a) Understand the variety of detergents.
Soapy detergents and soapless detergents
(b) Understand the mode of action of one of the detergents.

Soap molecules consists of hydrophilic end /water attractive and hydrophobic end/water repellent; when soap is

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FOOD ADDITIVES

Item 24

Ms. Balanda has a restaurant in Mbarara town. The customers have these days abandoned her restaurant because of poor taste of food, unpleasant scent and food gets spoilt after a short period of time. The appearance of cooked food is also not attractive and the soup is always too dilute. She wishes to acquire different substances which would be added to her food to produce meals attractive to her customers. She has contacted you as a chemistry student well knowing that you can advise her on the right products /substance to buy.

Task

Write a piece of advice to her on;

a) Category of the substance / product.
Food additives; these include flavours, preservatives, antioxidants, stabilizers, colourings etc

b) Uses of different substances/product.

Flavours; enhance aroma and taste of food

Preservatives; increase storage/shelf life of food by inhibiting growth of microorganisms on food.etc.

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c) Side effects of using the different products/substances on customers and mitigation.

Some people are allergic to food additives causing skin irritations. This can be mitigated by using recommended amounts.

Some food additives result into nervous disorders like sensitivity therefore affecting the normal functioning of the body. This can be mitigated by limiting on the use of food additives.

d) Evaluation of the substance/product.

Both natural and synthetic food additives improve the taste of food, preserve,etc

Natural food additives have less side effects compared to the synthetic food additives.

Item 25

On a wedding party guests were wondering and excited by the aroma of the food served, that it's so delicious.

The master of ceremony (MC) kept on notifying the people that the food had been prepared with knowledge of chemistry and some of the guests wanted to know what the Master of Ceremony meant.

Task;

As a chemistry learner, basing on the MC's communication, advise the guests on;

(a) The variety of the ingredients used.

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Exist as crystalline solid at room temperature.

iii) Explain how the compound is beneficial to the people in the community.

Used as a preservative, for example preserving fish.

Used as a food additive to give food taste.

iv) Explain the impact of the compound on the environment.

When continuously dumped in water bodies causes water pollution leading to the death of aquatic life e.g. fish. This can be mitigated through proper disposal of the product.

When dumped into soil causes soil salinity therefore lowers soil fertility hence low crop yields. This can be mitigated through proper disposal of the product.

MOLE CONCEPT

Item 31

An industry that manufactures cement uses limestone as the main raw material in the industry. Production of cement involves heating limestone strongly which results in its decomposition according to the equation;

$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$

The industry is also interested in knowing how much carbon dioxide is evolved during the process since the gas is useful. Before the production, an experiment was performed where 15g of lime stone where heated until there was no further change. You have been contacted for help.

Task;

As a learners of chemistry;

a) Explain the categories of products formed.
Ionic compound ;compound formed as a result of complete transfer of electrons from a metal to a non metal forming ions

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of opposite charge held by strong attractive force. For example calcium oxide.

Covalent compound; compound formed as result of sharing electrons between nonmetal atoms to attain a stable configuration eg carbon dioxide.

b) Suggest the properties of gaseous product.

Carbon dioxide is colourless

Soluble in water

More denser than air

Odourless

Tasteless

c) Calculate the volume of gaseous product formed measured at s.t.p.

R.F.M of $CaCO_3$=40+12+(16X3) =100

1 Mole of $CaCO_3$ produced I mole of CO_2

100g of $CaCO_3$ produced 22.4dm^3 of CO_2 at s.t.p

15g of $CaCO_3$ produced (22.4x15)/100dm^3 of CO_2

= 3.36dm^3 of CO2.

d) Explain the impact of gaseous product on the environment.

Accumulation of carbon dioxide in the atmosphere causes global warming since it is a greenhouse gas.

Charcoal is a common fuel used in many homes in Uganda. During its combustion in excess oxygen supply, it produces carbon dioxide. Your friend is using 20g of charcoal to cook food in a busy evening for guests. It burns completely as shown in the equation.

Item 32

$C(s) + O2(g) \longrightarrow CO2(g)$

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Tasks;

As a chemistry learner,

(a) Asses the type of product formed.

Covalent compound; formed as a result of sharing electrons between nonmetal atoms; for example carbon dioxide.

(b) Advise the friend on the appropriateness of the product formed.

Carbon dioxide is odourless, colourless, slightly soluble in water and denser than air.

(c) Calculate the volume of gas produced every busy evening.

(1 mole of a gas occupies 24dm3 at Rtp; C=12, O=16)

1 mole of charcoal produces 1 mole of carbon dioxide.

12g of charcoal produces 24dm3 of carbon dioxide at r.t.p.

20g of charcoal produces (20x24)/12 dm3 of carbon dioxide at r.t.p.

=40dm3 of carbon dioxide at rtp.

(d) Help friend understand impact of product environment and mitigation.

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can be mitigated by putting air filters in the chimney to absorb toxic/dangerous gases.

Industry produces a lot of noise which causes noise pollution mainly to workers .this results into damage of ears causing deafness. This can be mitigated by putting on noise protective gears to protect ears.

Social benefit

Provision of employment. This leads to gaining of income hence improving standards of living, etc.

Item 36

Following the outbreak of COVID 19, the cost for sanitizer increased suddenly and community members could not afford. A medical personnel was invited and advised them to use a cheaper alternative of using locally made ethanol since sanitizers contain mainly ethanol. The challenge is that the community members don't know how to produce ethanol locally.

Task;

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